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ABSTRACT

The purpose of this study was to determine the part of a word upon which first and fifth graders depend most in word recognition and to determine whether any change occurs between grades one and five. Fifty-six first grade students and sixty-three fifth graders were tested. The children individually read sixty words from flash cards presented by the examiner. Each word had up to one-third of its letters deleted in either the initial, middle, or final position. The words chosen were controlled for grade level, imagery rating, and consonant to vowel ratio. The findings showed that both first graders and fifth graders depend more upon the first part of a word than the other parts in reading. Fifth graders were consistently more accurate than first graders in recognizing words with any deletion pattern. On the basis of this study, it is evident that early reading instruction should focus the child's attention on the individual letters and their correspondence to pronunciation of English. (Author/TS)

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THE EFFECT OF LETTER DELETION
ON WORD RECOGNITION

AN ABSTRACT OF A THESIS
SUBMITTED TO THE FACULTY

OF

RUTGERS,

THE STATE UNIVERSITY OF NEW JERSEY

BY

CAROL V. BERTRAND

IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE

OF

MASTER OF EDUCATION

COMMITTEE CHAIRPERSON: EDWARD FRY, PhD

NEW BRUNSWICK, NEW JERSEY

JUNE, 1976

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ABSTRACT

The purpose of this study was to determine the part of a word upon which first and fifth graders depend most in word recognition and if any change occurs between grades one and five. It was hypothesized that there would be no difference in dependence upon word-parts and therefore no change between first and fifth grades.

Participants in this study were 119 boys and girls in an elementary school in an upper-middle-class suburban community in New Jersey. Fifty-six first grade students and sixty-three fifth graders were tested. The children individually read sixty words from flash cards presented by the examiner. Each word had up to one-third of its letters deleted in either the initial, middle, or final position. The words chosen were controlled for grade level, imagery rating, and consonant to vowel ratio.

The findings showed that both first graders and fifth graders depend more upon the first part of a word than the other parts in reading. Fifth graders were

consistently more accurate than first graders in recognizing words with any deletion pattern. An analysis of variance found a significant difference between initial and middle deletions and between initial and final deletions at the .01 level.

On the basis of this study it is evident that early reading instruction should focus the child's attention to the individual letters and their correspondence to pronunciation of English. Particular attention should be paid to the initial letters, for without them the word is much more difficult to synthesize.

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CHAPTER I

THE PROBLEM

When E. B. Huey performed his research experiments in reading around the turn of the century he was working in a relatively unexplored field. Seventy-five years later we find that little empirical knowledge has been added to Huey's findings, although more sophisticated instruments of measurement have helped to explain results somewhat more precisely.

Huey stated:

And so to completely analyze what we do when we read would almost be the acme of a psychologist's achievements, for it would be to describe very many of the most intricate workings of the human mind, as well as to unravel the tangled story of the most remarkable specific performance that civilization has learned in all its history.

(1908, p. 6)

Huey saw reading as an information-processing activity in which an arbitrary set of symbols is used to transfer information from one mind to another. Similarly, Goodman (1968) describes reading as the receptive phase of written communication. His experiments with temporally and

spatially transformed text have focused on finding out just how the skilled reader extracts information from print.

Words are the building blocks of concepts, is Taylor's belief. He is convinced that all parts of a word serve some function during word recognition although the reader responds to those parts with varying degrees of attention and scrutiny. In his experiments he obliterated part of each line of print and mutilated letters to determine how much of a word must be seen to be recognized.

A variety of experiments have been conducted in an effort to determine the part of a word on which a child relies most heavily in reading. Most of the studies involved adult readers and the results generally show that these readers perceive words in units rather than as individual letters. In the upper elementary grades general configuration of the words and initial letters appear to be as important as units within the words for recognition in reading.

Studies that have been done with children as young as first grade show a strong dependency on the initial letters with final letters being of almost equal

importance. Apparently no research evidence is available comparing differences in word perception between first and fifth grade children.

Statement of the Problem

The purpose of this study is to investigate the following questions: 1) Which third of a word is most vital to first graders in reading? 2) On which third of a word do fifth graders depend most heavily in reading? 3) Is there a shift in the parts of the word needed for recognition between first and fifth grades?

The following hypotheses guided this study: 1) There is no difference between the parts of a word used most by first graders in word recognition; 2) there is no difference between the parts of a word used most by fifth graders in word recognition; therefore 3) there is no difference between first and fifth graders in the word parts needed.

Importance of the Study

This study adds to our slowly growing understanding of how children perceive words in reading. Most previous studies have dealt with more mature readers, generally

college students, reading on a rather sophisticated level. This study proposed to investigate the word recognition styles of a number of first grade and fifth grade children and to then compare the results in terms of the part of the word which is most vital in recognizing the whole word for each group.

Limitations of the Study

In order to make the reading experience of the testing situation as close to normal school reading activities as possible, index cards were used with the words printed upon them. These were presented as flash cards and the length of each presentation could not be as accurately timed as it would have been had a tachistoscopic presentation been made.

The subjects were all students at one elementary school in an upper-middle-class suburban community in New Jersey. Therefore the findings are not necessarily true for all children.

Overview of the Study

Chapter II will provide a review of the literature relevant to word recognition. Various types of deletions

and mutilations of text will be discussed. In addition, studies on eye movement, redundancy of words, configuration, and attention to particular letters will be cited.

In Chapter III the methodology of the present study will be explained. This will include the sample of the study, instrumentation, data collection, and an explanation of the statistical treatment of data. The administration and results of the pilot study will be discussed as well as the changes made in the study as a consequence of the findings from the pilot study.

The data will be presented and discussed in chapter IV. Chapter V will summarize the study and state any conclusions or suggestions for further research not previously touched upon.

CHAPTER II.

REVIEW OF THE LITERATURE

Studies show that there is a wide variety of methods by which words are identified by children and adults. Some researchers insist that there is but one perceptual pattern for all readers while others suggest that readers mature in word perception as well as in other areas. Still others propose that different methods of word perception are used at different ages and for different types of reading.

In comparing fourth graders with adults, Samuels & Chen (1971) found that adults were faster at using all types of word recognition cues, i.e., single letters, graphemes, first and last letter, and word length, than were children, resulting in generally faster reading. They credited this to more experience with reading and therefore the ability to make more likely predictions of the words to follow, based on prior information about the words.

Studies on word perception range in their approach from using young children as subjects to adult participants, from tachistoscopic presentation of words to text presented as in normal reading, and from the use of real words to pronounceable non-words, digrams, trigrams, etc.

Individual Letters

Distinctive features of letters were examined by Forsky (1974) who found that letters with ascending parts were perceived faster than letters with descending parts, but that both were perceived faster than letters containing neither ascending nor descending parts.

Gibson (1969) found evidence that at a physiological level straight lines and curved lines are abstracted and responded to most readily as distinctive features of letters or letterlike forms. These are followed closely by intersections while redundancies and discontinuities are less vital features.

Vernon (1971), while conceding that since words have meaning and letters do not, children may learn to perceive words in wholes, says that "sooner or later, in order to perceive the essential structure of words [the child] has

to learn the characteristics of isolated letters and the manner in which they are combined in different words".

(p. 108)

Before the turn of the century Huey (1897), a pioneer in the field of word perception, cut words exactly in half and found faster and more accurate reading occurred when the first half of the word was present than when the second half was available to the reader. He attributed this to the tendency of English to place the accent on the first syllable and also to the preponderance of suffixes over prefixes in English, making the first part of the word the meaning-conveying part. His findings are verified by Broerse & Zwann (1966) who also state that even when the same number of letters is provided, production of nouns by the reader is easier when the initial letters are given than when only the final letters are available to the reader.

A number of other studies point to the first letter as the most salient cue in word identification. According to Eriksen & Eriksen (1974), "readers use their knowledge of the sound-spelling correspondences in English to progress sequentially from left to right in the most efficient

way possible" (p. 71). They delayed tachistoscopic presentation of one letter in each of the positions of four-letter words. Readers had the most difficulty when the first letter was delayed. In cases where pronunciation of the first letter depended upon the second letter, response time was about the same for a second letter delay as for a first letter delay.

Working with kindergarten and first grade children, Swenson (1975), Timko (1970), and Williams, Blumberg, & Williams (1970) found that letter cues, and particularly first letters, are used most frequently by these younger children. While this dependence was less marked, Singer, Lappin, & Moore (1975), working with adults, still found that "the first part of a word supplies information about the nature of subsequent letters" (p. 192). Swenson noted also that older readers tend to note trigrams more than individual letters.

Garner (1962) summarized a number of other studies which show that subjects have the least difficulty with a word when it is the middle letters that are deleted, transposed, or altered in some way. He goes on to say that "the beginnings and ends of words carry the greatest information, and the middle letters of words are the most redundant" (p. 259).

Configuration

General configuration of a word is a relatively unimportant cue in word identification. Retarded children are actually hampered in learning words when stress is placed upon configuration in teaching rather than on the identification of individual letters. Normal children showed no difference in learning when either letter or configuration cues were stressed (Vandever & Neville, 1974).

Timko (1970) and Williams, Blumberg, & Williams (1970) found word shape to be a minor cue used by beginning readers and occasionally a basis for word choice by some adults. However, there is apparently no justification for developing beginning reading instructional materials with configuration as the primary cue.

Once a reader becomes used to or "cracks the code" of a particular style of writing, print, or mutilation he has facility with passages written in quite bizarre manners, according to Smith (1969). Travers (1973a) similarly concluded that children learn structural rules which facilitate processing of letter clusters, but that these rules are apparently independent of the specific appearance of letters. They can be applied to a wide variety of typefaces and handwriting styles.

Conversely, Cohen (1975) found that fifth graders had significantly more difficulty attempting to read words with a mixed case configuration than words appearing in lower case letters only. First graders did not experience this difficulty, although they had a lower mean rate of words read correctly in both experimental situations. She attributes this to first graders' attention to individual letters, particularly initial letters, while fifth graders rely more on the general configuration of the word.

Eye Movement

Theories on eye movements vary from the belief that a reader scans the letters of a word one-by-one to that of perception based on a single fixation. Adults and, in fact, most readers show a definite left-to-right pattern of scanning for the recognition of all but the final letter of a word, according to Engel (1974). He agrees with a 1958 study by Bruner & O'Dowd (which he quotes) who suggested that the space following the final letter aids in its recognition.

Some non-reading boys tend to remember final letters best. This could be due to the fact that they remember the last letter seen in a left-to-right scan or, more likely,

they scan a word from right-to-left, not having learned the manner in which English is written (Marchbanks & Levin, 1965).

Massaro (1973) contradicts the scanning theory and states that "the recognition of a string of letters involves a readout of the visual features of the letters available in a given eye fixation" (p. 353). He cites redundancy or English orthography as the major cause of improved performance when the letter strings form words or familiar spelling patterns.

Whole-Word Theory

While Smith (1969) insists that there is no tendency for words to be identified as wholes, a number of researchers would disagree with him. Johnson (1975) noted that there is an inconsistency between his and previous studies based on duration of presentation of the visual material. He claims that tachistoscopic flashes were too brief for the reader to process units within words. Smith showed that letters in words are identified more easily than letters in isolation, but Johnson found that whole-word and single-letter identification are both faster than identifying the first letter of a word.

He is supported by Lakner (1974), Travers (1973b), Broadbent & Gregory (1971), and Henderson (1974). They found that mature readers process words in a parallel process rather than in a serial one. Travers, through further experimentation, found no evidence that the parallel effect extends beyond words to short phrases, however. Henderson discussed three explanations for the superiority of words over phrases in initial identification: meaning, familiarity, and orthographic structure. He admits that familiarity is not an independent factor but is, at different levels, an aspect of either meaningfulness or of orthographic structure of words.

Serial processing involves scanning the word with attention given to each letter or word-part for a fraction of a second. Only one part of the word is attended to at any given moment.

In parallel processing, all bits of input are examined simultaneously and the outcome of analysis by one part of the retina is independent of other analytic processes. Neisser (1967) relates parallel processing to perception because of the redundancy, wastefulness, and freedom from gross misrepresentation inherent in both.

Grapheme-Phoneme Correspondences

Gibson et al. (1963) worked with first and third grade children. They presented the same three-letter units as words, pronounceable trigrams, and unpronounceable trigrams. They concluded that "in the early stages of reading skill a child typically reads in short units but has already generalized certain consistent predictions of grapheme-phoneme correspondence, so that units which fit these simple 'rules' are more easily read" (p. 146). These units expand as the child's reading skill develops.

Mutilated Text

Huey (1908) found that "more words were made out, and in less time, when the first halves were read than when the latter halves alone remained" (p. 97). Rayner & Kaiser (1975) and Miller & Friedman (1957) used various types of mutilated text to locate the part of the word of major importance to the reader. They found that mutilations to the beginning of words are most disruptive to word recognition. Miller & Friedman further found that superior readers could read passages abbreviated by as much as fifty per cent, but that they were more accurate in restoring letters omitted at the ends of words than at the beginnings of words. Rayner

& Kaiser substituted letters within words and found that visually distinctive letters are more disruptive to reading than are visually similar letters.

Redundancy in Words

The area of word frequency or redundancy has been studied by many researchers, including Baddeley (1964), Biemiller (1970), Broadbent & Gregory (1968), Smith & Haviland (1972), King-Ellison & Jenkins (1954), and Broerse & Zwann (1966). They state that words common in the language are more easily perceived than unfamiliar or non-words because there are fewer small units to be processed. Baddeley concluded that the more redundant the letter sequence and the longer the exposure time, the more effectively the sequence of letters can be decoded.

Familiar letter groupings are recognized faster than unfamiliar ones when presented as parts of long sequences of letters, according to Postman & Conger (1954). They further state that "the speed of recognition for letter sequences varies significantly with the strength of the verbal habits associated with the stimuli" (p. 673).

Kolers & Perkins (1969) contend that orientation is an independent factor important in the construction of per-

ceptions rather than just a byproduct of perceptual processing. They also suggest that this orientation is a set of behavior fixed for a particular reading task, and is not computed anew for individual letters.

Spoehr & Smith (1973) found that one-syllable words were processed in a more unitary manner than two-syllable words and attributed this to a perceptual difference in subvocalization rather than in syllables.

The unit of recognition was defined as the "letter-group which has an invariant relationship with a phonemic pattern" by Gibson et al. (1962). They found it to be dependent on what precedes and what follows but less dependent on sequential probability than on written English as it is related to spoken English.

Individuals differ in their methods of attending to, and their abilities to perceive, the letters of the alphabet. Crosland & Johnson (1928), found three distinct perception styles among people: 1) those who consistently perceived the first three or four letters accurately regardless of the number of letters presented to them, 2) those whose range increased as the number of available letters increased, and 3) those whose range was small and scattered over the various letters presented to them.

Summary

Upon reading some of the available studies on word perception one has to agree that there are inconsistencies and contradictions in the findings. Some researchers find evidence of serial processing while others go along with a parallel processing theory. Some see configuration as an important cue while others disregard it or see word shape as a minor cue. Some see accurately-timed tachistoscopic presentations as the only scientific method while others contend that duration of presentation is of minimal importance.

Many of these difficulties arise from the fact that the subjects and their number, the materials, and the methods of research differ so widely. When one takes them into perspective a few trends are obvious.

The studies done with young children tend to show that these children depend most upon the first letter in reading words. By later childhood or adulthood there is a shift toward parts of the whole word as the dominant factor in word recognition. In fact, several studies point out that adult readers perceive words more quickly than they can identify the initial letters of words. This has significance

for the Gestalt theory of perceiving a thing as a whole rather than as a summation of its parts.

This study was an attempt to learn if words are processed in parts and which parts are most vital to the reader. Since the subjects were two distinct groups - beginning readers and children of late elementary school age - a comparison of reading styles could be made between them. The methods used and the results of the study may be found in the following chapters.

CHAPTER III

METHODOLOGY

The purpose of this study was to learn upon what part of a word a first grader depends most in word recognition, the part of a word upon which a fifth grader is most dependent, and if any change occurs in style of word recognition between first grade and fifth grade. Deletions of up to one-third of the initial, middle, or final letters were made to each word used for the purposes of the study.

Population

The subjects were all of the sixty-five first graders and all of the sixty-six fifth graders who attended an elementary school in an upper-middle-class suburban community in New Jersey in the 1975-1976 school year. The 1970 census listed the population of the town as 16,031. The median family income was \$13,703, which was fourteen per cent higher than that for the surrounding county. It is a compact residential community with a population density of 5,725 persons per square mile. Thirty-three

boys and thirty-two girls participated in the first grade portion of the study and twenty-eight boys and thirty-eight girls participated in the fifth grade part. The children in the fifth grade had scored above average on the 1974 statewide assessment. No scores were available for the grade one children.

Construction of Instrument

The words chosen for the study were selected from van der Veur's (1975) list of high imagery words. As far as possible, only those words with an imagery rating of 4.0 or higher were used. These were then compared to Fry's (1972) graded Instant Words for first and fourth grades. Only words which appeared on both Fry's and van der Veur's lists were used.

From the lists so derived, certain words were omitted. Compound words were generally avoided as it was felt by the examiner that a deletion in the middle of a compound word might be unusually disruptive to the reader. To avoid confusion, care was taken that the words chosen not have too many common possible insertions of letters. For example, the word "cat" was not used as "_at" could

be reconstructed as "bat, eat, fat", etc., "c_t" could be "cot" or "cut", and "ca_" could be "cab, can, cap", etc. So many possibilities might be puzzling, especially to the younger children.

Each word had up to one-third of its letters deleted. Therefore, one letter was deleted from words of three, four, or five letters, two letters were deleted from words of six, seven, or eight letters, and three letters were deleted from words of nine or more letters. The deletions were made at the beginning of twenty of the sixty words used for each grade, in the middle of twenty words, and at the end of twenty words. In each of the three deletion patterns approximately two-thirds of the letters deleted were consonants and one-third were vowels to roughly correspond to the normal consonant-vowel distribution in elementary textbooks. A complete listing of the words and their deletions can be seen in Appendix A and Appendix B.

The test words were presented as flash cards. They were typed with a primary typewriter (which yields one-fourth inch letters) on three-by-five index cards. A blank was shown for each missing letter.

Data Collection

The children were tested individually on the flash cards. Before presentation of the words each child was told: "On each of these cards is a word with one or more letters missing. I will show you the word very quickly. I want you to tell me what you think the word would be if all of the missing letters were there. I don't expect you to know all of the words, but I would like you to try to say as many as you can." Each word was exposed for about one second. After the child's response, the cards were sorted into two piles (recognition and non-recognition) to be recorded later.

After the cards were completed, the child was asked to read aloud a list containing all of the test words intact. This was done to make sure that he/she did not miss a word because of unfamiliarity with it. Only the words the child could recognize as sight words were used in the statistical analysis.

The tests were carried out during January and February of 1976. The examiner, who was familiar to the children as a teacher in the school, did all of the testing. The tests were performed in a quiet corner of the school away

from classroom distractions. No child saw or heard the words until it was his/her turn to be tested.

Statistical Analysis

The mean scores were computed for each of the three deletion patterns for each grade. An analysis of variance compares the results of the test both within and between grades. Percentages of total words identified correctly were computed for each deletion pattern as well as for consonants and vowels in each pattern. A comparison was also made of the words of each word length recognized by each group of children.

In the appendix can be found the lists of words used for each grade as well as an ordering of the words from easiest to hardest by deletion pattern for each grade.

Pilot Study

The subjects used in the pilot study were those children present in a nearby Sunday School's first and fifth grade classes on November 30, 1975. These children attend public schools in the community sampled and an adjoining township. The examiner was a person familiar to them and they showed no anxiety over the tasks.

For the pilot study the flash cards were presented as well as a second deletion test. The words for this test were printed on a sheet of typing paper. First grade words were printed three-eighths of an inch high and fifth grade words were typed with a pica typewriter. As with the flash cards, a blank was present for each letter deleted. The children were asked to fill in the missing letters as well as they could.

The most valuable information to emerge from the pilot study was that the paper-and-pencil portion of the test was not a fair test of word recognition, but depended upon a child's skill in spelling. Subsequently that part of the test was eliminated completely and the flash card test was increased from thirty to sixty words for each grade.

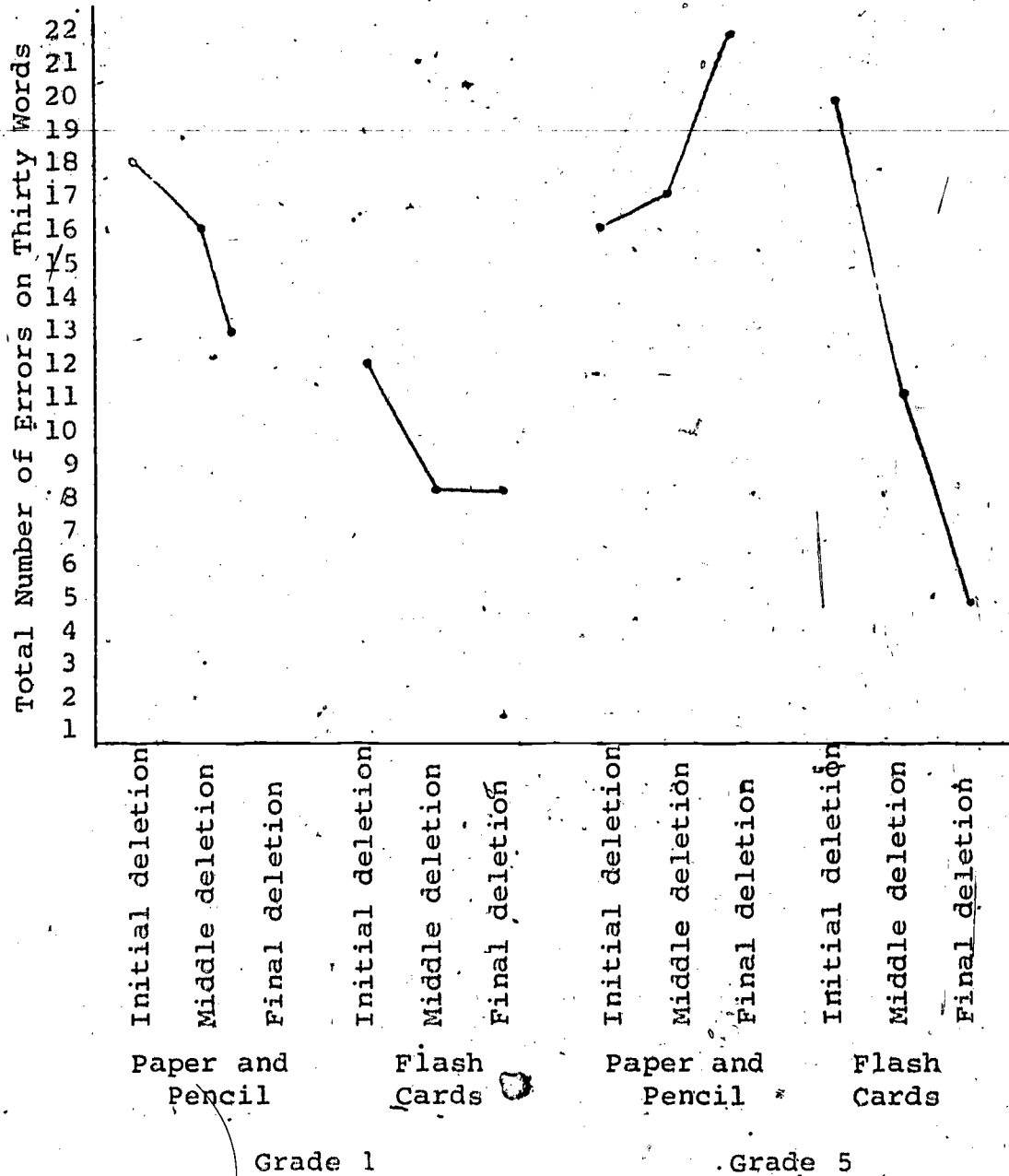
It was also found that if a child were going to recognize a word at all he generally did so in an instant, and prolonged exposure of the word did not significantly augment recognition. Thus the exposure time of about one second per word was deemed sufficient.

As the pilot study was done when the first graders had been exposed to reading for three months or less,

there were a number of words that were unknown to several of the children. Because it would be invalid to make a statement on the effect of the position of the deletion if a child simply did not know the word, these words were eliminated from the analysis of errors. As it required only about one minute to have a child read the entire list of sixty words when printed intact, this precaution was well worth the time spent.

Figure 1 shows a composite analysis of the errors made on the pilot tests. The composite was necessary because the small n made a comparison between individual scores meaningless.

TABLE 1
COMPOSITE ERRORS MADE ON PILOT TEST



CHAPTER IV

FINDINGS AND DISCUSSION

Sixty-five first grade students and sixty-six fifth grade students were the subjects of this study. Of this number the results of nine of the first graders and three of the fifth graders were omitted. Six of the first graders were non-readers and three had continued absences during the time of the testing. The three fifth graders had a great deal of difficulty with the words and exhibited considerable confusion and anxiety over the test. For this reason the examiner felt that their results were invalid. Therefore, the first grade analysis is calculated on the performance of the remaining fifty-six first grade students while the fifth grade analysis is based upon sixty-three students.

The children were told by their teachers that what they were doing would help the examiner write a paper for college. This impressed them and they approached the task eagerly. Complete cooperation was received from the

seven teachers and 119 children involved in the study. One six-year-old said, with a twinkle in his eye, "Are you ever in trouble now? I'm a very good reader and I bet I'll know all of your words." It was found that a minute or two spent in getting to know the first graders greatly facilitated the testing situation. Fifth graders needed no such introductory period and were ready to perform the task immediately.

The Problem

The problem was to determine: 1) which third of a word is most vital to first graders in reading, 2) on which third of a word fifth graders depend most heavily in reading and, 3) if there is a difference in the parts of a word needed for recognition between first and fifth grades.

Sight Words

The testing situation consisted of each child being shown sixty flash cards, each containing one of the words for his/her grade with either an initial, middle, or final deletion. This was followed by a list of all of the words from the cards, printed intact, which the child

was asked to read. The words the child did not know as sight words were eliminated from the statistical analysis.

All of the fifth grade students were able to read all sixty words as sight words. This was not the case with the first grade children. Six of these children knew all sixty words while one child knew only four. The other forty-nine children knew between seven and fifty-nine words each. A more detailed breakdown can be seen in Table 1.

TABLE 1

NUMBER OF SIGHT WORDS RECOGNIZED
BY FIRST GRADE CHILDREN

Number of Words	Number of Children
1 to 6	1
7 to 12	9
13 to 18	3
19 to 24	8
25 to 30	5
31 to 36	1
37 to 42	3
43 to 48	5
49 to 54	6
55 to 60	15

Because of the heavy concentration of children who knew less than half of the words and another large group who recognized fifty to sixty of the words we might conclude that these first graders either knew almost all of the words presented and apparently were well on their way in learning to read or were struggling along, learning each new word as it was presented by their teacher. There were few children in the middle.

Mean Scores

Fifth grade students were able to recognize more words with and without deletions. The mean scores were computed for each grade in each of the deletion patterns: initial deletion, middle deletion, and final deletion. These can be seen in Table 2.

TABLE 2

MEAN NUMBER OF WORDS READ CORRECTLY FOR EACH DELETION PATTERN

Grade	Initial Deletion	Middle Deletion	Final Deletion
1	2.86	5.88	6.54
5	14.43	17.56	16.48
Total	8.98	12.06	11.80

The lowest mean score for each grade is in the initial deletion pattern. In each case it fell two to three points below the means for the middle and final deletion patterns. Figure 2 is a graphic representation of the mean scores.

Analysis of Variance

The analysis of variance between grades one and five shows that one group (grade five) performed significantly better than the other (grade one) at the .01 level. Since different words were used for each grade, this finding is not particularly relevant despite its significance. There is virtually no difference between the middle and final deletion patterns. However the difference between the initial and middle deletion patterns and between the initial and final deletion patterns is significant at the .01 level. Initial letters are most vital for all readers. The total scores show a tendency for final letters to be next in importance with middle letters least important for word recognition, although the analysis shows no statistical significance in this area. The two-way interaction between grade and pattern also showed no statistical significance. (See Table 3).

FIGURE 2

COMPARISON OF MEAN NUMBER OF WORDS READ CORRECTLY
FOR EACH DELETION PATTERN FOR EACH GRADE, AND TOTAL

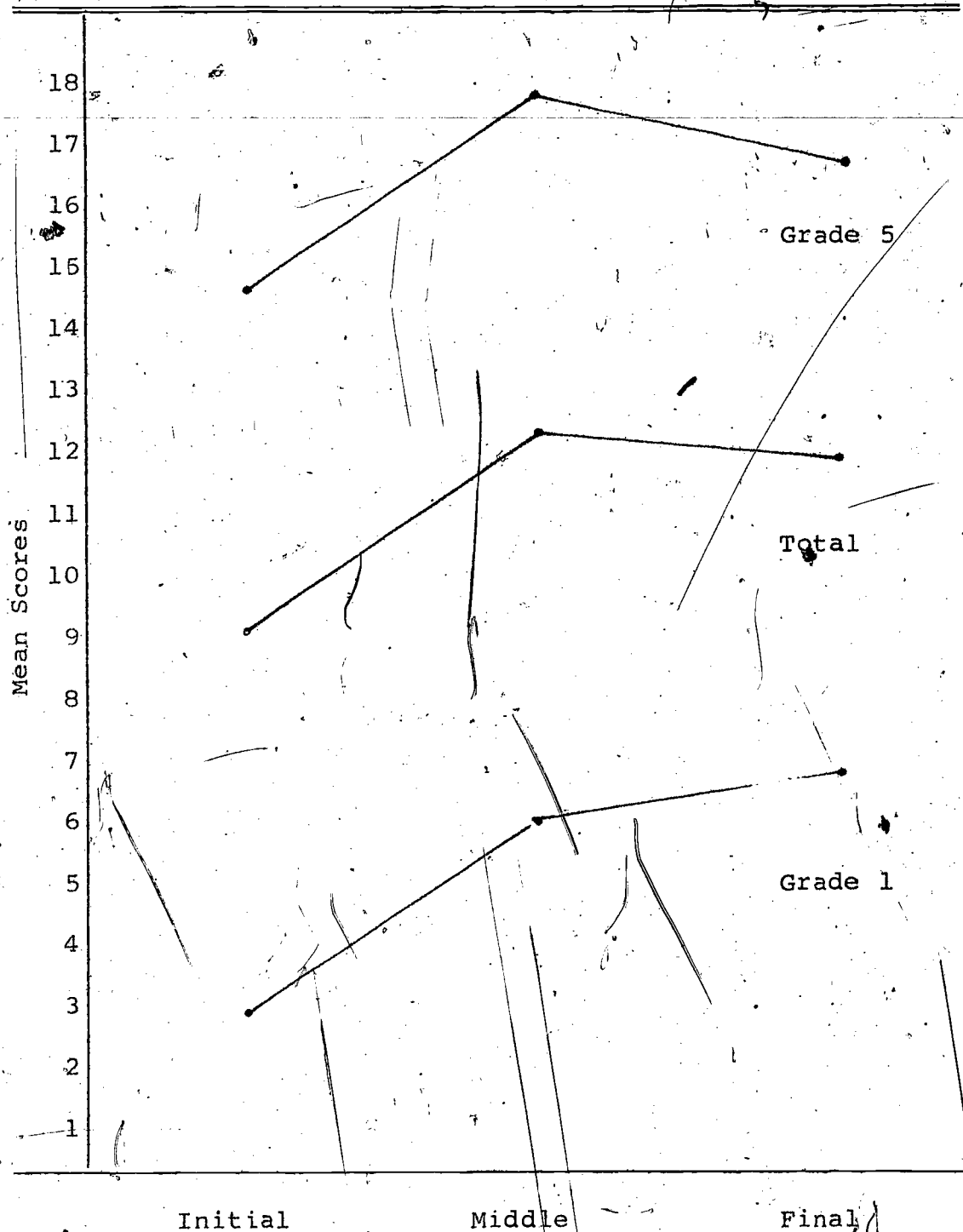


TABLE 3
ANALYSIS OF VARIANCE

Source of Deviation	DF	Sum of Squares	Mean Square	F
Grade	1	10751.5	10751.5	932.0 ^a
Pattern	2	742.0	371.0	32.2 ^b
Gr. x Pat.	2	52.4	26.2	2.3 ^c
Error	351	4045.1	11.5	
Total	356	15591.1		

a. Since different words were used for each grade, this score is not applicable.

b. Significant at the .01 level.

c. No statistical significance.

Deletion Patterns

First graders were able to identify 100 per cent more words with a middle deletion than they were with an initial deletion and 130 per cent more words with a final deletion than with an initial deletion.

Table 4 shows the total number of sight words that were recognized by each grade, listed by deletion pattern. This is followed by the total number of words with deletions recognized by the children. Since a direct comparison between grades is not appropriate due to different words having been used as well as the fact that first graders did not know all of the sight words,

the scores were equalized by using a percentage. These scores yield the information that initial deletions were more difficult for both grades with middle deletions somewhat harder than final deletions for first grade. Fifth graders experienced slightly more difficulty with final deletions than they did with middle deletions.

TABLE 4

TOTAL NUMBER OF SIGHT WORDS KNOWN, TOTAL NUMBER OF DELETION WORDS KNOWN AND PER CENT OF WORDS CORRECTLY IDENTIFIED FOR EACH DELETION PATTERN

Grade	Initial			Middle			Final		
	Sight	Del.	%	Sight	Del.	%	Sight	Del.	%
1	611	160	26	759	329	43	660	369	56
5	1260	908	72	1260	1128	89	1260	1038	82

The difficulties the children experienced with the initial deletions should come as no surprise as the importance of initial letters as a word recognition cue has been cited repeatedly. "The first letter in the word seems to be utilized more often by beginning readers than any other cue" (Timko, 1970, p. 69). "The first

graders...showed a strong tendency to match on the basis of individual letters, the initial letter being particularly salient" (Williams et al., 1970, p. 314).

"Apparently all of the readers tend to look at the word beginning" (Swenson, 1975, p. 415). "The first part of a word supplies information about the entire word, more so than other word parts" (Singer et al., 1975, p. 192).

"In general, the initial part of the word contains more information; the more information is given in a word part, the more easily the word is identified" (Broerse & Zwann, 1966, p. 445).

Specific Word Difficulties

A look at the words which gave children the most difficulty reveals that first graders tend to say what they see and find it hard to synthesize a longer word from a shorter one. The ten hardest first grade words (each recognized with deletions by no more than three children) were "down" (do_n), "both" (bot_), "open" (_pen), "white" (_hite), "her" (_er), "thing" (_hing), "give" (gi_e), "kind" (ki_d), "lost" (lo_t), and "high" (hig_). In all cases except perhaps "gi_e" the letters appeared as a pronounceable three or four letter string

and the examiner noted that the children responded by pronouncing that string. This phenomenon is much less evident in the case of the fifth grade words.

This can at least partly be explained by Gibson's (Gibson et al., 1963) findings. He concluded that a beginning reader generalizes certain predictions of grapheme-phoneme correspondence, so letter strings which fit the rules are recognized more easily. Gradually the span increases and so the rules become more complex.

An interesting result, although the word is not located at the extreme of the most difficult words (it is fourteenth in difficulty) was the word "present" (prese_). The word "parrot" had recently been introduced in the first grade readers and most of the children responded with "parrot" upon seeing a long word beginning with a "p". Configuration very likely played a part in this identification.

When we consider the easiest words the pattern changes. The nine words with deletions correctly identified by over half of the first grade children were: "can" (c_n), "box" (b_x), "run" (ru_), "eat" (e_t), "look" (lo_k), "play" (p_ay), "red" (re_), "home" (hom_),

and "five" (fiv_). In most cases the deletion did not leave a pronounceable string of letters, forcing the child to attempt to synthesize the complete word.

Left-to-Right Scanning

In several instances the first grade children read from right to left. This was especially apparent in the word "two" (_wo), which at least twenty per cent of the children read as "owl". Likewise, "her" (_er) was often pronounced "red" and "head" (_ead) was pronounced "dear" by several of the children. The right-to-left scanning was only noted when the initial letter was deleted from the word. Evidently if a series of letters is unfamiliar to a beginning reader he will look at all of the letters in any order to try to make sense out of them. There was no evidence of right-to-left scanning among the fifth grade subjects.

Right-to-left scanning was also noted by Marchbanks & Levin (1965) who observed it particularly among boys of kindergarten and first grade age. The present study on letter deletion did not note sex differences.

Among the fifth graders the word "order" (_rder) was noted by the examiner to be unusually difficult for the children. To see if there were a problem with the specific word or with the initial vowel deletion, several more words with an initial vowel deletion were presented. These additional words and the number of children who correctly identified them may be seen in Table 6. It was found that the fifth graders recognized only thirty-five per cent of them, a far lower percentage than the eighty-one per cent of the total fifth grade words correctly identified.

TABLE 6

ADDITIONAL FIFTH GRADE INITIAL VOWEL DELETION WORDS AND THE NUMBER OF CHILDREN WHO IDENTIFIED THEM *

Word	Deletion	$\frac{o}{n}$
eyes	_yes	0
'eagerly	_gerly	3
open	_pen	12
all	_ll	24
early	_arly	25
off	_ff	27

* These words were presented to only forty-three children.

First grade words had three initial vowel deletions: "all" (_ll), "one" (_ne), and "open" (_pen). All three ranked in the more difficult half of the words. The implication seems to be that children do not anticipate initial vowels in words and attempt to synthesize the word in another way.

Word Length

The number of letters in a word did not significantly affect the ease with which it was recognized by either first grade or fifth grade subjects. Except for the three word lengths for which there was but one fifth grade word (words of three, eight, and nine letters) the number of words of each length correctly perceived was within eleven percentage points for each grade. This can be seen in Table 7.

Summary of Findings

While fifth graders consistently performed better than first grade children in all deletion patterns, the results for each grade across deletion patterns are fairly consistent.

TABLE 7

NUMBER OF WORDS OF EACH WORD LENGTH CORRECTLY IDENTIFIED

Length	Grade 1 <u>n</u> = 56			Grade 5 <u>n</u> = 63		
	Sight	Del.	%	Sight	Del.	%
3	526	236	45	*63	61	97
4	953	393	41	1134	970	86
5	337	153	45	1323	1038	78
6	180	61	34	819	632	77
7	39	15	38	315	254	81
8				*63	63	100
9				*63	56	89
Total	2035	858	42	3780	3074	81

* Only one word of this length was used in the test.

Initial deletions caused the words to be most difficult to recognize, and if that deletion were a vowel it compounded the problem. These findings are consistent with the literature on the importance of the first part of a word in reading.

First graders had the most difficulty reconstructing a word when it was a pronounceable string of letters with the deletion, i.e., "do_n, bot_, _pen". They seemed to become baffled by the three or four letter string they saw and could not proceed from there.

Some evidence of right-to-left scanning was noted among the younger subjects. There was no evidence of this among the older students.

The length of the word had virtually no effect on its ease of identification. Fifth graders regularly identified approximately forty per cent more words of each length than did first graders.

CHAPTER V

SUMMARY AND CONCLUSIONS

This study attempted to find out whether one part of a word is more important than another as an aid in word recognition. Sixty words, carefully chosen for imagery value and grade level, were presented to first graders and another sixty were presented to fifth graders. Up to one-third of the letters of each word were deleted and a blank was left to indicate each missing letter. The deletions followed three patterns - initial, middle, and final letters - and there were twenty words for each pattern among the words for each grade. The consonant to vowel correspondence was controlled at approximately a 2:1 ratio for each deletion pattern.

Conclusions

This study found that both first and fifth graders had significantly more difficulty recognizing the words when the initial letters were deleted. Statistically

significant, too, were the differences in performance between first graders and fifth graders.

There were not significant differences between the middle and final deletions although a trend, different for each grade, was found. According to this study there was a tendency for first graders to depend upon the middle word part somewhat more than the final part while fifth graders depended upon the final part slightly more than the middle part.

The purposes of the study were to determine 1) upon which part of a word first graders depend most, 2) upon which part of a word fifth graders depend most, and 3) if there is a difference between first and fifth graders in the importance of parts of a word for recognition. The results show that 1) first graders depend most on the initial letters, 2) fifth graders depend most on the initial letters, and 3) there is no significant difference between first and fifth graders in the importance of parts of a word for recognition.

Whether the deletion were a consonant or a vowel mattered only if it were in the initial deletion pattern. A non-statistical finding was that initial vowel deletions were more difficult for both grades.

Percentages were tabulated on word length to see if this made a difference, but no statistical analysis was done. It was found that word length was not a factor in recognition in this study.

Limitations

Most first grade children's reading vocabularies are rather limited. Delaying the testing until the end of the school year, or using second graders as subjects, should permit a larger n of sight words within the younger group of children.

The comparison of word lengths was suggested to the examiner after the testing was completed. Further studies might be conducted using words of only two different lengths to better control for this factor.

Implications

Observing the children as they read the words with deleted letters, it was obvious that the most successful ones had learned to associate sounds with letter patterns. The examiner believes, on the basis of this study, that early reading instruction that forces attention to each letter, with emphasis on the initial letters, is most

likely to produce subsequent success in reading. This agrees with Huey's (1908) findings on the importance of the first part of the word in word recognition. It also corresponds to Massaro's (1973) study which indicated that if spelling rules are well-learned and utilized by the reader, a string of letters can be identified from partial information.

Fifth graders in this study appeared to synthesize words more as syllables than as individual letters and showed less dependence on the initial letters than did first graders. Gibson et al. (1962) also found that as the child matures in his reading skills he perceives "super forms" which correspond to auditory-vocal temporal patterns. Redundancy, imagery rating, and meaningfulness also become factors in success in reading by older children, but early instruction must focus upon individual letters and their correspondence to pronunciation of English.

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APPENDIX

APPENDIX A

GRADE ONE WORDS SHOWN INTACT AND WITH DELETION

all	_ll	ball	ba_l	back	bac_
color	_olor	box	b_x	black	blac_
first	_irst	can	c_n	book	boo_
fork	_ork	dear	d_ar	both	bot_
friend	_iend	down	do_n	call	cal_
head	_ead	eat	e_t	five	fiv_
her	_er	four	f_ur	girl	gir_
left	_eft	give	gi_e	good	goo_
many	_any	kind	Ki_d	hand	han_
one	_ne	little	li__le	high	hig_
open	_pen	long	lo_g	home	hom_
pretty	_etty	look	l_ok	house	hous_
school	_hool	lost	lo_t	leave	leav_
stand	_tand	morning	mo__ing	live	liv_
thing	_hing	mother	mo__er	make	mak_
three	_hree	name	na_e	people	peop__
two	_wo	night	ni_ht	present	prese__
under	_nder	out	o_t	red	re_
white	_hite	play	p_ay	right	right_
you	_ou	tree	t_ee	run	ru_

APPENDIX B

GRADE FIVE WORDS SHOWN INTACT AND WITH DELETION

baby	_aby	bridge	br__ge	aunt	aun__
beautiful	__utiful	children	chi__ren	catch	catc__
chair	_hair	class	cl__ss	dinner	dinn__
cousin	__usin	country	cou__ry	doctor	doct__
family	__mily	farm	fa_m	drop	dro__
floor	_loor	fight	fi_ht	egg	eg__
friend	__iend	fish	fi_h	evening	eveni__
green	_reen	half	ha_f	father	fath__
happy	_appy	heart	he_rt	nine	nin__
horse	_orse	king	ki_g	paper	pape__
hundred	__ndred	milk	m_lk	picture	pictu__
lady	_ady	music	mu_ic	rest	res__
month	_onth	number	nu__er	sick	sic__
order	_rder	room	r_om	study	stud__
party	_arty	spring	sp__ng	suit	sui__
short	_hort	talk	t_lk	summer	summ__
step	_tep	teacher	tea__er	uncle	uncl__
stick	_tick	train	tr_in	winter	wint__
swim	_wim	twelve	tw__ve	women	wome__
window	__ndow	yard	ya_d	world	worl__

APPENDIX C

GRADE ONE WORDS ORDERED FROM EASIEST TO HARDEST
BY DELETION PATTERN

No. of Children	Initial	Middle	Final
41		can	
40		box	
37			run
35		eat	
33		look	
30		play	red
29			home
28			five
27			girl, house
26		tree	
24			make
20			black, live
19		night	
18	color, pretty		hand, right
17			leave
16	you		back, good
15		four	
14		ball	
13	fork, left	out	people
12		name	
11		mother	call
10		morning	
9	all, under		book
8	three, one		
7	first	dear, little	
6	friend, head, school	long	
5	stand		present.
4	many, two		
3	her, thing	give, kind, lost	high
2	open, white		
1		down	both.

APPENDIX D

GRADE FIVE WORDS ORDERED FROM EASIEST TO HARDEST
BY DELETION PATTERN

No. of Children	Initial	Middle	Final
63		children, class, king, milk, train	picture
62		room	
61		music	summer, egg
60		half	doctor, uncle
59	horse	talk	nine
58	happy, window	teacher, bridge	
57		fish, yard	dinner
56	month, swim, beautiful		paper
55		fight, twelve, country	
54	friend		study
53			rest, suit
52	baby, party, step		
51		heart	
50	hundred		winter
49	floor		catch, deep, women
47		spring	
46			sick
45			aunt
44			world
43	green, cousin		
41		farm	father
40	lady		
35	short		
31	order	number	
30	stick		
28			evening
17	chair, family		

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